APPENDIX A

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OXIDATION RESISTANCE OF FILTER MATERIALS

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by

S R J SAUNDERS AND T G DYE

NATIONAL PHYSICAL LABORATORY
Teddington
Middlesex TW11 OLW

Approved on behalf of Director, NPL by Dr E D Hondros, Superintendent, Division of Materials Applications

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(Appendix to DMA(D)250)

S R J Saunders and T G Dye

1. INTRODUCTION

The corrosion behaviour of fibres of Type 310 stainless steel, Inconel 601, Hastelloy X and Fecralloy fabricated into sheet form was studied at 600 ^{o}C in combustion gases with and without HCl additions.[1,2] This work demonstrated that the Fecralloy samples were the most resistant to attack, and that if treated prior to exposure an improvement in performance could be obtained which was related to the formation of a protective layer of Al_2O_3. However, some fibres (less than 1%) in the treated and untreated Fecralloy samples showed extensive attack of regions with a high yttrium content.

Further work was requested by Bekaert on uncorroded Fecralloy samples taken from various stages of manufacture in order to investigate the cause of this attack. In addition, confirmation of enhanced Al_2O_3 formation due to the pretreatment was sought. Also information about the silicon and copper distribution in all the samples previously corroded in the NPL rig was requested. This report presents the results of this work.

2. EXPERIMENTAL

Samples were mounted in Edgemount and polished as previously described. Microprobe analysis was also carried out using the same conditions as for the earlier work.[2]

3. RESULT and DISCUSSION

3.1 Analysis of uncorroded Fecralloy samples

Four types of uncorroded Fecralloy sample were examined; untreated and not sintered, treated and not sintered, untreated and sintered and treated and sintered.

Second phase particles were occasionally detected in both types of non-sintered fibre by optical microscopy using the Pepperhoff method of coating the sample with a thin layer of an interference film. Microprobe analysis of these areas was carried out and the set of X-ray images which are shown in Figures 1 and 2 (untreated) and Figure 3 (treated) indicate the presence of a yttrium-rich phase. Quantitative analysis of the larger particles was possible and the results are shown in Table I.

Table I Analysis of Fecralloy fibres

Sample		composition, wt%				
		Fe	Cr	Al	Y	Total
Treated: (figure 3)	i) matrix	82.2	14.8	1.5	0.04	98.54
	ii) Y-rich intermetallic	69.4	10.4	5.9	17.6	103.3
Untreated: (figure 2)	i) matrix	82.8	15.7	5.2	0.05	103.75
	ii) Y-rich intermetallic	67.9	9.6	5.8	17.3	100.5

The results for the treated sample shown in figure 3 also indicate that a well developed layer of Al_2O_3 was present and that as a consequence of its formation the matrix was severely depleted in aluminium. The quantitative results shown in Table I confirm this observation. It is of interest to note, however, that the composition of the Y-intermetallic was not affected by the aluminium-depleted matrix. This suggests that the intermetallic "locks-up" the aluminium in the Fecralloy, making it less available for the formation of a protective Al_2O_3 layer.